

What we claim is:

1. A multimeric hybrid gene, comprising a gene sequence coding for an antigenic region of a protein from a first pathogen linked to a gene sequence coding for an antigenic region of a protein from a second pathogen.
2. The hybrid gene of claim 1 wherein said first and second pathogens are selected from bacterial and viral pathogens.
3. The hybrid gene of claim 2 wherein both said first and second pathogens are viral pathogens.
4. The hybrid gene of claim 1 wherein said first and second pathogens are selected from those causing different respiratory tract diseases.
5. The hybrid gene of claim 4 wherein said first and second pathogens causing different respiratory tract diseases are selected from the paramoxyviridae family of viruses.
6. The hybrid gene of claim 1 wherein at least one of said gene sequences is mutated while retaining antigenicity.
7. The hybrid gene of claim 6 wherein said mutation is at a putative pre-termination site.
8. The hybrid gene of claim 1 wherein said first pathogen is parainfluenza virus (PIV) and said second pathogen is respiratory syncytial virus (RSV).
9. The hybrid gene of claim 1, comprising at least one gene sequence coding for a parainfluenza virus (PIV) protein linked to at least one gene sequence coding for a respiratory syncytial virus (RSV) protein.
10. The hybrid gene of claim 9, wherein said parainfluenza virus protein is selected from PIV-3 F and HN proteins and said respiratory syncytial virus protein is selected from RSV G and F proteins.
11. The hybrid gene of claim 1 consisting of a gene sequence coding for a human PIV-3 F or HN protein or an

immunogenic epitope-containing fragment thereof linked to a gene sequence coding for a human RSV G or F protein or an immunogenic epitope-containing fragment thereof.

12. The hybrid gene of claim 11 which is selected from  $F_{PIV-3} - F_{RSV}$ ,  $F_{RSV} - HN_{PIV-3}$  and  $F_{PIV-3} - G_{RSV}$  hybrid genes.

13. The hybrid gene of claim 1 contained in an expression vector.

14. The hybrid gene of claim 13 in the form of plasmid pAC DR7, pD2 RF-HN or pD2 F-G.

15. The hybrid gene of claim 1 further comprising at least one gene encoding at least one immunogenic and/or immunostimulating molecule.

16. Cells containing the multimeric hybrid gene of claim 1 for expression of a chimeric protein encoded by said gene.

17. The cells of claim 16 which are bacterial cells, mammalian cells, insect cells, yeast cells or fungal cells.

18. A chimeric protein, comprising an antigenic region of a protein from a first pathogen linked to an antigenic region of a protein from a second pathogen.

19. The protein of claim 18, wherein said first and second pathogens are selected from bacterial and viral pathogens.

20. The protein of claim 19 wherein both said first and second pathogens are viral pathogens.

21. The protein of claim 18, wherein said first and second pathogens are selected from those causing different respiratory tract diseases.

22. The protein of claim 21 wherein said first and second pathogens causing different respiratory tract diseases are selected from the paramoxyviridae family of viruses.

23. The protein of claim 18, wherein said first pathogen is parainfluenza virus (PIV) and said second pathogen is respiratory syncytial virus (RSV).

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24. The protein of claim 18 comprising at least one parainfluenza virus (PIV) protein linked to at least one respiratory syncytial virus (RSV) protein.

25. The protein of claim 24, wherein said PIV protein is selected from PIV-3 F and HN proteins and said RSV protein is selected from RSV G and F proteins.

26. The protein of claim 18 consisting of a human parainfluenza virus-3 (PIV-3) F or HN protein or an immunogenic epitope-containing fragment thereof linked to a human respiratory syncytial virus (RSV) G or F protein or an immunogenic epitope-containing fragment thereof.

27. The protein of claim 26 which is selected from  $F_{PIV-3} - F_{RSV}$ ,  $F_{RSV} - HN_{PIV-3}$  and  $F_{PIV-3} - G_{RSV}$  chimeric proteins.

28. A process for preparation of a chimeric protein which comprises:

isolating a gene sequence coding for an antigenic region of a protein from a first pathogen,

isolating a gene sequence coding for an antigenic region of a protein from a second pathogen,

linking said gene sequences to form a multimeric hybrid gene, and expressing the multimeric hybrid gene in a cellular expression system

29. The process of claim 28 wherein said multimeric hybrid gene comprises a gene sequence coding for a PIV-F or HN protein or an immunogenic epitope-containing fragment thereof linked to a gene sequence coding for a human RSV G or F protein or an epitope-containing fragment thereof.

30. The process of claim 29 wherein said multimeric hybrid gene is selected from  $F_{PIV-3} - F_{RSV}$ ,  $F_{RSV} - HN_{PIV-3}$  and  $F_{PIV-3} - G_{RSV}$  hybrid genes.

31. The process of claim 30 wherein said multimeric hybrid gene is contained in an expression vector comprising plasmid pAC QR7, pD2 RF-HN or pD2 F-G.

32. The process of claim 28 wherein said cellular expression system is provided by bacterial cells,

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mammalian cells, insect cells, yeast cells or fungal cells.

33. The process of claim 32 including separating a chimeric protein from a culture of said cellular expression system and purifying the separated chimeric protein.

34. A live vector for antigen delivery containing the gene of claim 1.

35. The live vector of claim 34 which is a viral vector.

36. The live vector of claim 35 wherein said viral vector is selected from poxviral, adenoviral and retroviral viral vectors.

37. The live vector of claim 34 which is a bacterial vector.

38. The live vector of claim 37 wherein said bacterial vector is selected from salmonella and mycobacteria.

39. A vaccine against diseases caused by multiple pathogenic infections, comprising a chimeric protein comprising an antigen region of a protein from a first pathogen linked to an antigenic region of a protein from a second pathogen, and a physiologically-acceptable carrier therefor.

40. The vaccine of claim 39, wherein said first and second pathogens are selected from bacterial and viral pathogens.

41. The vaccine of claim 39, which also contains at least one other immunogenic and/or immunostimulating molecule.

42. The vaccine of claim 40 wherein both said first and second pathogens are viral pathogens.

43. The vaccine of claim 39, wherein said first and second pathogens are selected from those causing upper and lower respiratory tract diseases.

44. The vaccine of claim 39, wherein said first pathogen is parainfluenza virus (PIV) and said second pathogen is respiratory syncytial virus (RSV).

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45. The vaccine of claim 39 against infection by both parainfluenza virus (PIV) and respiratory syncytial virus (RSV), comprising a recombinant multimeric protein containing at least one segment consisting of a PIV protein or an immunogenic epitope-containing fragment thereof linked to at least one segment consisting of a RSV protein or an immunogenic epitope-containing fragment thereof, and a carrier therefor.

46. The vaccine of claim 45 wherein said recombinant multimeric protein is a recombinant chimeric protein containing a segment consisting of a PIV-3 F or HN protein or an immunogenic epitope-containing fragment thereof linked to a segment consisting of an RSV G or F protein or an immunogenic epitope-containing fragment thereof.

47. The vaccine of claim 46 containing at least one additional protein of PIV or RSV or chimeric protein thereof.

48. The vaccine of claim 39 wherein said carrier comprises an adjuvant.

49. The vaccine of claim 39 wherein said carrier is an ISCOM, a liposome or a microparticle.

50. The vaccine of claim 46 formulated to be administered in an injectable form, intranasally or orally.

51. The vaccine of claim 39 further comprising means for delivering said multimeric protein specifically to cells of the immune system.

52. The vaccine of claim 51 wherein said delivery means comprises a toxin molecule or an antibody.

53. A vaccine against diseases caused by multiple pathogenic infection, comprising a live vector as claimed in claim 34, and a physiologically-acceptable carrier therefor.

54. A method of immunizing a host against diseases caused by multiple pathogenic infections, which comprises

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administering to a host an effective amount of a vaccine as claimed in claim 28 or 53.

55. The method of claim 54 wherein said vaccine is against diseases caused by parainfluenza virus (PIV) and respiratory syncytial virus (RSV).

56. The method of claim 55 wherein said host is selected from infants, young children, pregnant women, women of child-bearing age and susceptible persons.

57. A diagnostic reagent for detecting infection by a plurality of different pathogens in a host, comprising the chimeric protein claimed in claim 18.

58. A method of detecting infection by a plurality of different pathogens in a host, which comprises using said chimeric protein claimed in claim 18.

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